Energy+Environmental Economics

CPUC Customer-Generation Successor Tariff/Contract Options Stakeholder Meeting

August 11th, 2014

Today's Agenda

- **Overview of Proposed Approach**
  - Introduction of the E3/LBNL/Advent team
  - Goals and scope of the analysis
  - Overview of proposed approach and timeline
- **Discussion of Modeling Approach**
  - Presentation of analytical approach and data inputs for the population of the public tool
- **Discussion of the Public Tool**
  - Presentation of proposed scope of analytical and technology options for the public tool
- **Discussion of Successor Tariff Options for the Analysis**
  - Presentation of proposed pricing mechanisms for the public tool

Today's Goals

Two main goals:

1. **Propose an approach for comment that describes how we plan to evaluate successor tariff contract options**
   - Methodology and data
   - Range of tariff or contract options considered
   - Public tool capability and functionality
2. **Solicit stakeholder feedback on the proposed approach**
   - With all of these decided, we can proceed with building the tools and completing the analysis

Overview of Proposed Approach
10:30 – 11:15 a.m.

Overview of Proposed Approach

- Introduction of the E3/LBNL/Advent team
- Goals and scope of the analysis
- Overview of proposed approach and timeline

Energy + Environmental Economics (E3)

- E3 has operated at the nexus of energy, environment, and economics since it was founded in 1989
- Advises regulators, utilities, government agencies, power producers, energy technology companies, and investors on a wide range of critical issues in the electricity and natural gas industries
- 35 professional staff in economics, engineering & policy
- E3 has created a range of stakeholder tools, including:
  - E3 Public Model, Bill Calculator, and Avoided Cost Model from the NEM 1.0 Ratepayer Impacts Evaluation
  - "E3 Calculator" used in evaluating the cost-effectiveness of California IOU energy efficiency programs

Lawrence Berkeley National Lab Electricity Markets & Policy Group

- Conducts public interest research on energy efficiency, demand response, renewables, transmission planning, resource planning, and reliability within the U.S. electricity sector
- Employs a range of interdisciplinary methods and tools appropriate to the topic at hand, including primary data analysis, economic analysis, statistical analysis, modeling, and survey and interview-based research
- Provides insight and information to public and private decision-makers through direct technical assistance, publications, and presentations
- Makes work publicly available, to aid and inform all interested stakeholders: http://emp.lbl.gov/

LBNL Works at the Intersection of Distributed Resources and Utility Business Models

Quantifying the Financial Impact of Distributed Solar on Utility Rates and Profitability

Impacts of Retail Rate Design and Net Metering on PV Economics

EE Business Models Analysis and Technical Assistance

Solar Valuation at High Penetration

Tracking Activity on Future Regulatory and Utility Business Models

Advent Consulting

- Founder: Dr. Jerry Bowers

- Engagements include research projects for the California Public Utilities Commission, the California Energy Commission, the California Air Resources Board, and the Sacramento Municipal Utility District

Overall Project Scope

- **Develop a Public Tool that enables stakeholders to evaluate NEM successor contract/tariff structures that:**
  - Balance competing goals in AB 327 (Perea, 2013) for all customers
  - Encourage the sustainability of renewable distributed generation (DG) and support CPUC policies and goals like efficiency, storage, etc.
- **Provide support to the CPUC Energy Division:**
  - Support stakeholder process
  - Support the Commission's development of a successor contract/tariff by December 31, 2015
  - Provide additional information pertaining to customer generation to help inform the residential rates in Order Instituting Rulemaking (OIR), proceeding R.12-06-013

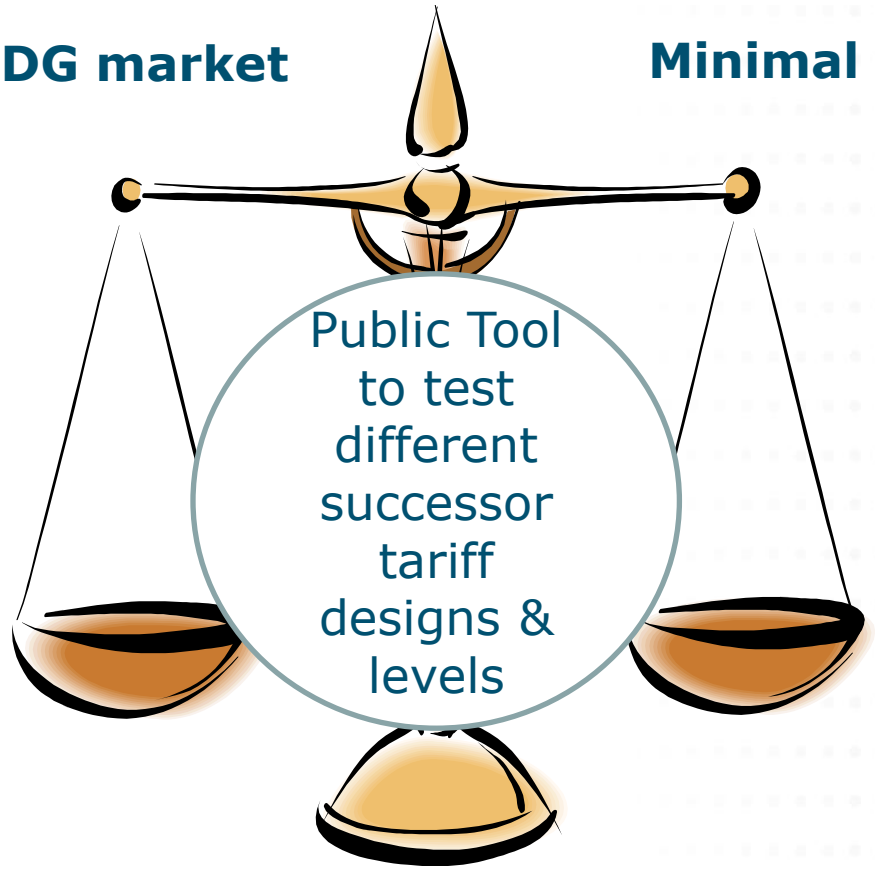
Scope of Public Tool

- **With the passage of AB 327, the legislature has asked the CPUC to perform a balancing act**
  - Support a growing "sustainable" market for renewable DG in California
  - Minimize the cost impacts associated with current NEM policies with limitations on the changes possible to the rate design so that the total benefits of the successor tariff/contract are "approximately" equal to the total costs

AB327 NEM Balancing Act

"Sustainable" DG market

Minimal cost-shifting



Renewable DG Owners

Financial proposition
- IRR
- Payback

3rd Party DG Providers

Industry growth

Market transformation

Rate and bill impact

Non-participating Customers

Policy and Regulation Drivers

- **Our analysis must consider a number of precedents and constraints according to statute and policy, including:**
  - AB 327 (Perea, 2013)
  - SB 594 NEM Aggregation (Contiguous Accounts)
  - Rule 21 (Interconnection standards)
  - Zero Net Energy Buildings (ZNE)
  - Commission's Energy Storage Targets
  - Tax Policy (ITC and Property Tax Exemptions)
  - Self-Generation Incentive Program (Non-Solar)
  - SB 43 ("Green" Tariff)

Role of the Public Tool

- **The Public Tool is being developed for several reasons:**
  - To provide a common "language" to talk about all stakeholder proposals and ideas
  - To provide an equal opportunity for all stakeholders to analyze and test their proposals and ideas without favoring a single stakeholder
  - To provide auditability and vetting of calculation by stakeholders
- **The Public Tool is not designed to pick a "best" answer**

Approach to Tool Development

+ Internal tools – LBNL FINDER Model, SAS load research

- Our team will adapt several analysis tools to forecast the three investor-owned utilities' (IOUs) revenue requirements, cost of service allocations to class, rate designs, and customer loads
- Due to the data size and complexity, multiple modeling platforms are required to model these outcomes
- Large data request delivered to IOUs in June, collection underway

+ Public Tool

- We will use this forecast in a publicly-available Excel spreadsheet that will allow the stakeholder community to vary the key drivers of most interest for each of the California IOUs
- This may become a separate tool for each IOU, depending on size and manageability

Public Tool Timeline

- **Kickoff Workshop**
  - Workshop - August 11, 2014
  - Workshop Summary – September 2014
- **'Draft Model' Workshop Materials**
  - Workshop Presentation + Draft Public Tool + Draft User Guide – December 2014
- **'Final' Successor Contract/Tariff Public Spreadsheet Tool including User Guide – January 2015**
- **Final Report on Range of Findings – March 2015 (Pending the Commission's final Rates OIR decision)**

Stakeholder Discussion

- Any comments/concerns about the proposed approach of developing a public tool in conjunction with a report containing the results from the tool?
- Any lessons learned from prior quantitative analyses or public tools, including the tool recently developed in the retail rates proceeding, that are relevant for this analysis?

Break
11:15 – 11:30 a.m.

Discussion of Modeling Approach
11:30 a.m. – 12:30 p.m.

Modeling Approach: Agenda

- 2013 NEM Project & Comparison to Successor Tariff
- Overview of modeling approach
- Input data
- Internal tools to populate the Public Tool
- Calculations in the Public Tool
- Public Tool results and output metrics
- Stakeholder discussion

Takeaways from 2013 NEM Study

- **E3 study (2013)**
  - Part of a legislative directive to determine "who benefits and who bears the economic burden, if any, of the net energy metering program"
- **Four analyses conducted:**
  - Cost-benefit of NEM (investigate cost impacts)
  - Cost of service evaluation
  - Public purpose charge savings
  - Income demographic assessment to learn about household incomes of NEM participants

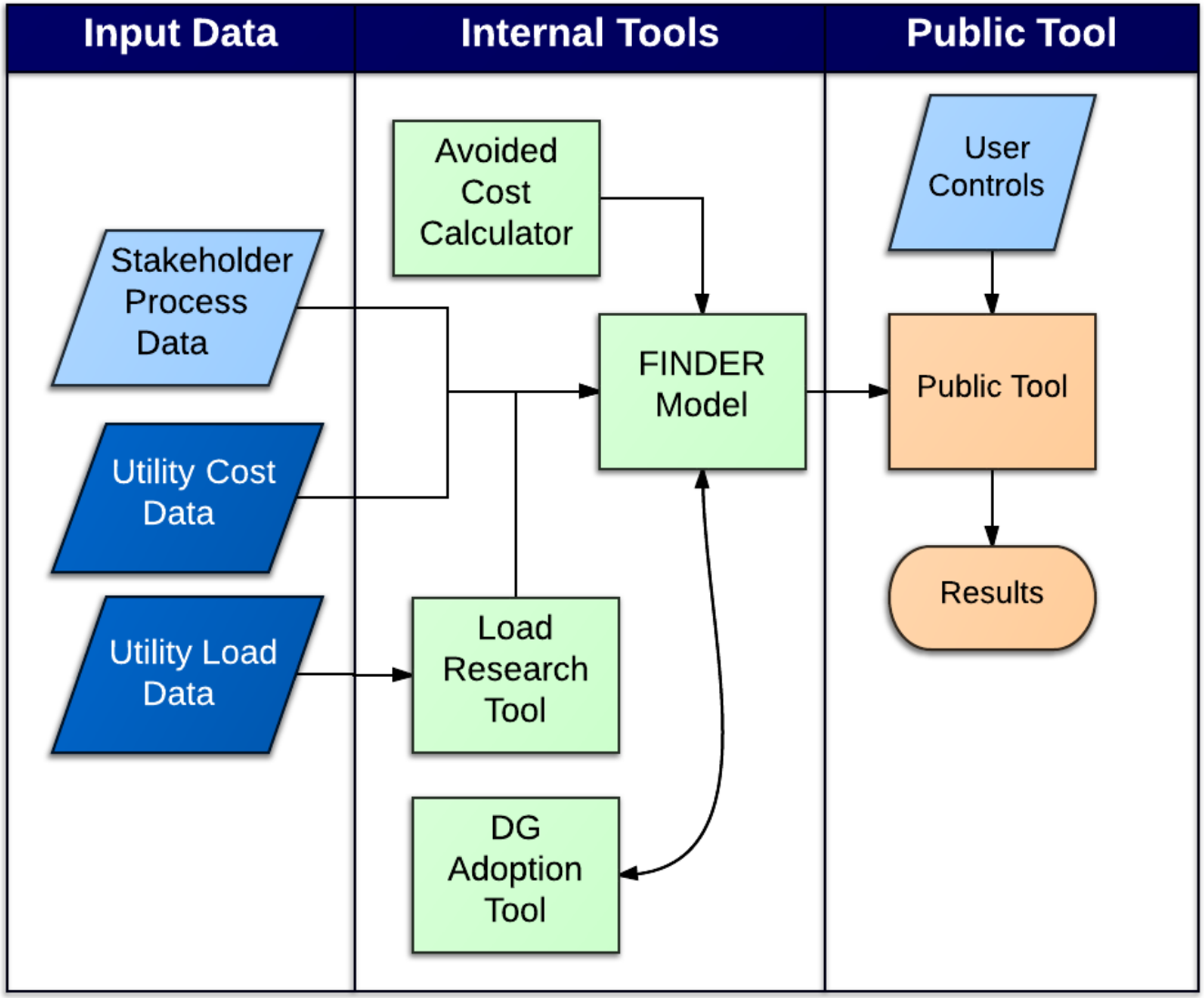
Differences Between this Project and the 2013 NEM Study

- **Modified tariff designs**
  - The prior study only evaluated the rate structures in place, with no ability to modify them
- **Adequate rate levels**
  - Alternative rate designs will ultimately collect the utility's allowed revenue requirement while incorporating changes to billing determinants
- **PV adoption**
  - We will be able to evaluate the change in adoption rates by explicitly testing the viability of the PV market under various pricing mechanisms
- **Given these aims, the tools developed for the 2013 NEM ratepayer impact assessment cannot provide the data necessary for this project**

General Approach to the Modeling

- **Plan to develop characterizations of each California IOU to estimate changes over time in:**
  - Revenue requirements
  - Customer billing determinants
  - Cost allocations to customer classes
- **Several E3/LBNL internal tools employed in previous analyses will be used to populate public tool**
- **Public tool will be able to analyze successor tariff or contract options**
  - Will focus analysis options in those areas that stakeholders have the most interest

Overview of Modeling Approach



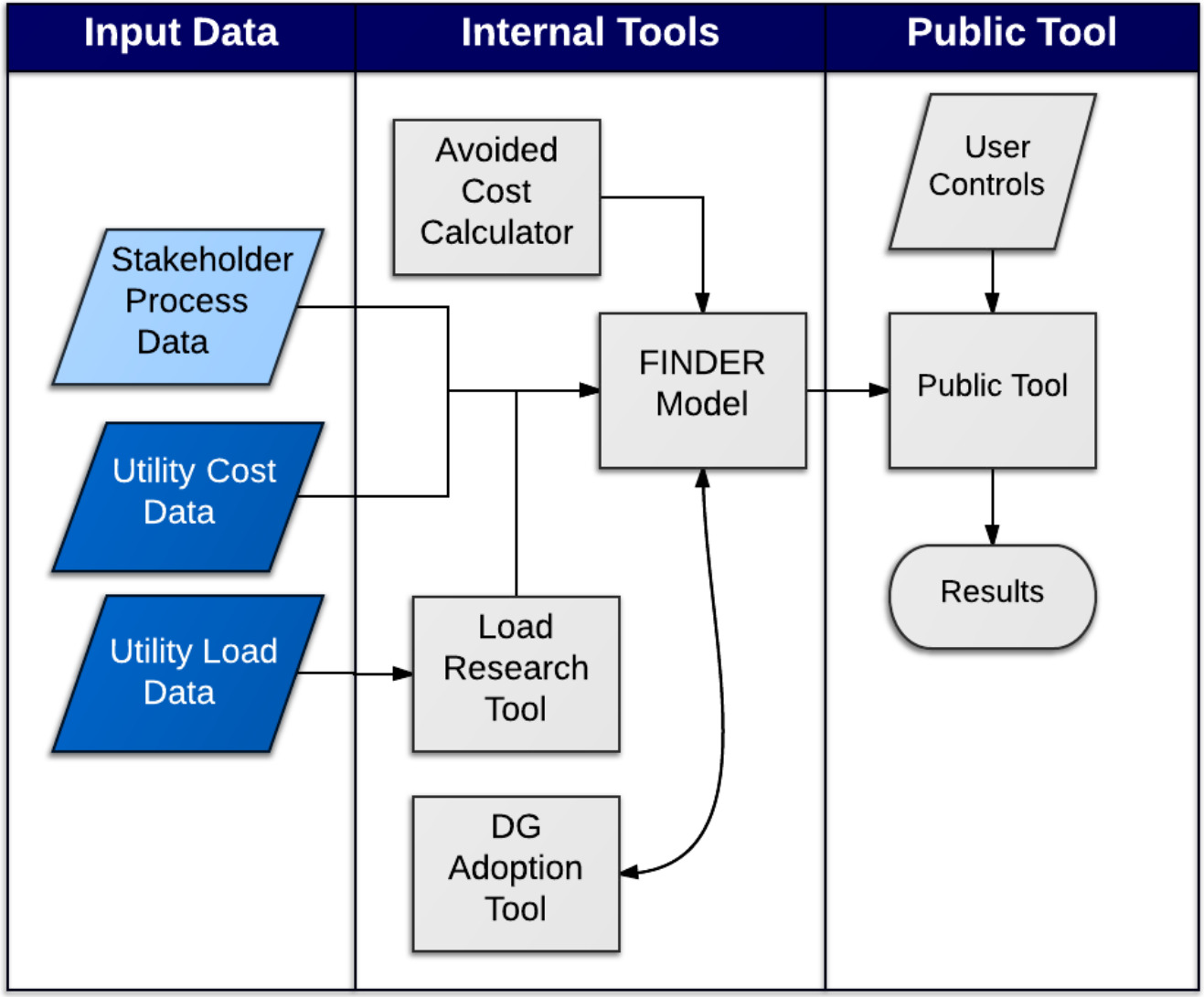
Stakeholder Input is Critical

- **Stakeholder input is critical in this process**
- **Our approach balances two key objectives:**
  - Providing stakeholders with sufficient information needed to evaluate and recommend alternative rate structures and pricing mechanisms, while protecting confidential data
  - Incorporating complex model detail from multiple software platforms into a user-friendly public tool, focusing on key sensitivities necessary to analyze alternative rate structures and their impacts on participating and non-participating customers

Modeling Constraints

- **Deterministic model with various pre-loaded cases that drives the Public Tool with limited feedback**
- **Term of rate structure must be long enough to repay investment in DER**
- **Alternative rate designs must ultimately collect the utility's allowed revenue requirement**
  - Impacted by rate structure and billing determinants
- **Renewable DG adoption rates may be a function of:**
  - Rate levels - economic test
  - Policy

Input Data


Input Data
Internal Tools
Public Tool
Avoided Cost Calculator
User Controls
Stakeholder Process Data
FINDER Model
Public Tool
Utility Cost Data
Results
Utility Load Data
Load Research Tool
DG Adoption Tool

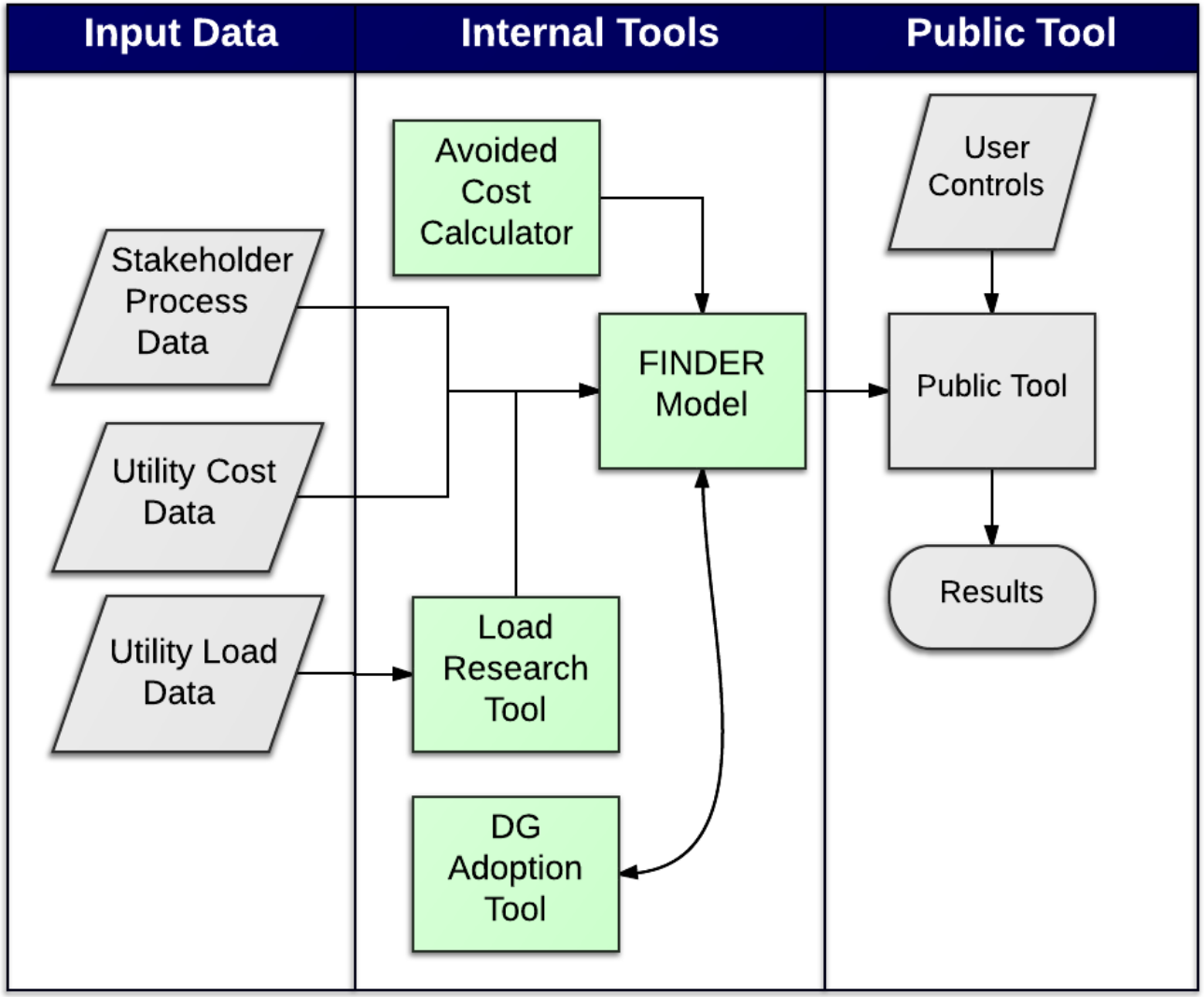
Data Sources

- **Data previously provided to the CPUC for the 2013 NEM analysis; particularly load research samples**
- **Data delivered by the IOUs through data request**
  - Revenue requirement components for each utility
  - Cost allocation inputs / method to each customer class
  - Data from most recent general rate case (GRC)
- **Information made public as part of a prior GRC or other source (e.g., stakeholder feedback)**
- **Source of renewable DG installation cost data**
  - Data from E3 and LBNL analyses

Customer Classes Examined for NEM Compensation

- **Residential**
  - Residential
  - Residential CARE
- **Commercial**
- **Agricultural**
- **Industrial**
- **The Public Tool will not be able to model specific customer types (i.e., schools, hospitals)**

Internal Tools



Avoided Cost Calculator

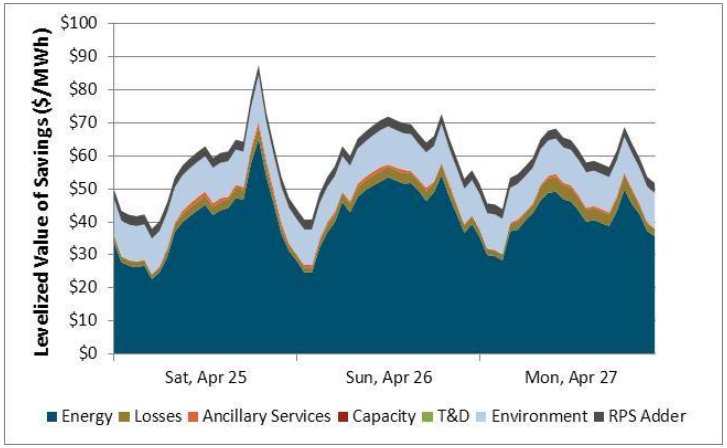
+ Benefits Included

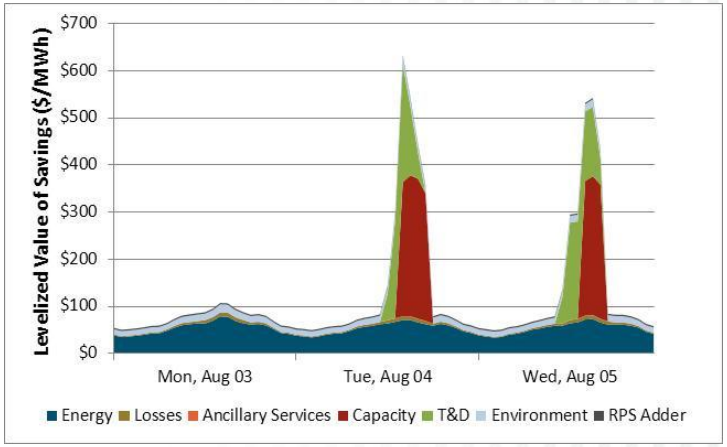
- Energy Purchases
- Generation Capacity
- T&D Capacity
- GHG Emissions
- Losses
- Ancillary Services Procurement Reduction
- Reduced RPS procurement

+ CPUC proceedings with similar approach

- Energy Efficiency
- DG Cost-effectiveness
- Demand Response

Three-Day Avoided Cost Snapshots





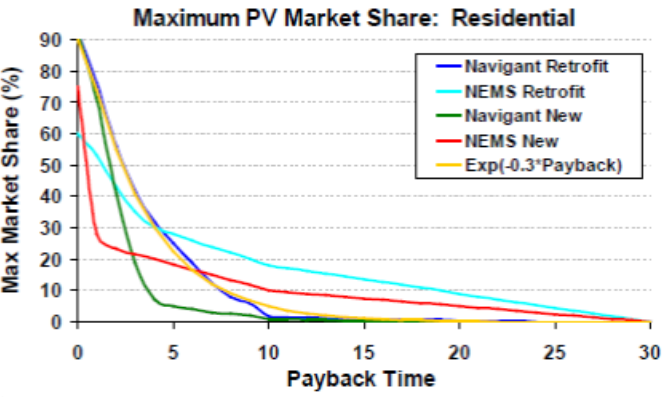
Publicly available at:
http://www.ethree.com/documents/E3%20Calculator%2009.20.11/2011_Avoided_Cost_Update.zip

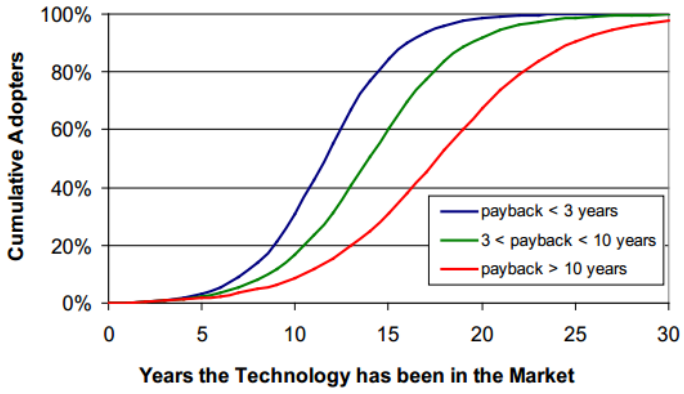
Load Research Tool

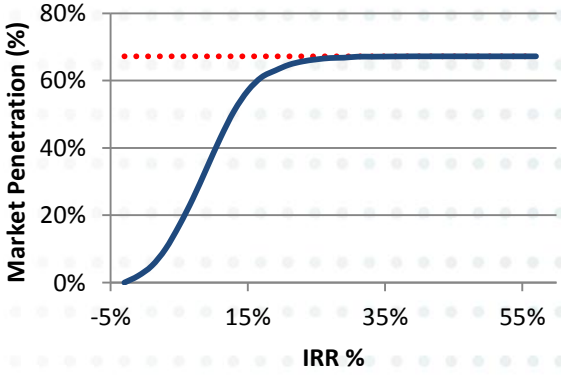
- **Combines load research data on customer profiles for each utility, rate class, climate zone, and size to develop representative billing determinants for the utility population by customer class**
- **Number of accounts**
- **Non-coincident peak demand**
  - TOU, Season, Voltage Level
- **Energy**
  - TOU, Tier, Season
- **Note: The load research data from the 2013 NEM ratepayer impact study only characterized NEM participants**

Existing Renewable DG Adoption Tools

- **E3 (2014) solar PV tool based on NREL's Solar Deployment System (SolarDS) model:**
  - Maximum PV market share as a function of payback period
    - **Can also look at internal rate of return (IRR) and sales/market growth metrics**
  - Logistic curves for adoption
- **Solar PV and other renewable DG can also be modeled by direct user input in the Public Tool**

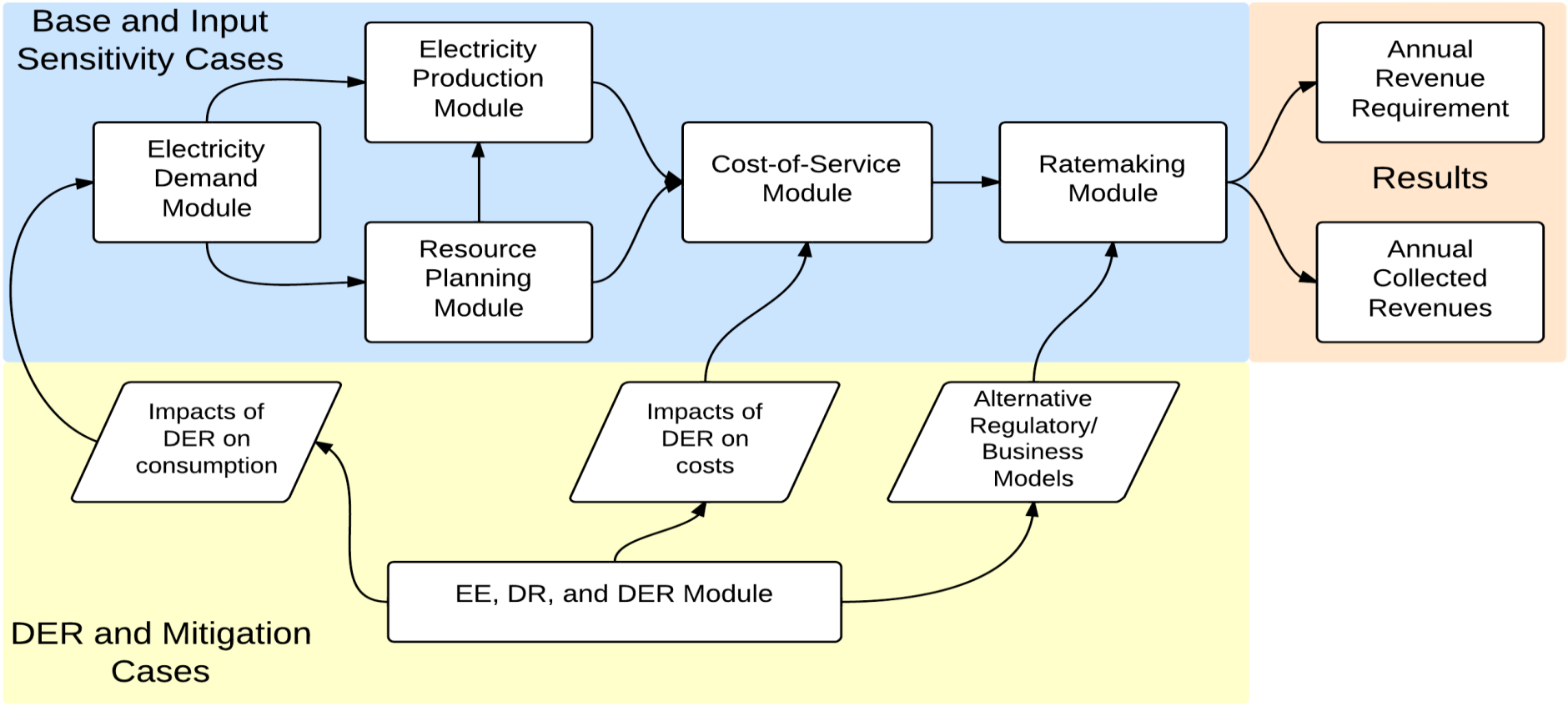






Energy+Environmental Economics

FINancial impacts of DER (FINDER) Model



- FINDER Model can forecast each utility's revenue requirement and collected revenue by customer class given assumptions on cost drivers, billing determinants, and underlying rate design

FINDER Model Components

Electricity Demand Module

- Customers
- Retail sales
- Peak demand
- T&D losses

Electricity Production Module

- Utility owned generation portfolio
- Purchased power contracts

Cost of Service Module

- Fuel and purchased power
- Non-fuel O&M
- Capital expenditures
- Average debt cost
- Debt interest
- Authorized return on equity
- Return on ratebase
- Deprecation
- Taxes

Distributed Energy Resource (DER) Module

- DER impacts (feeds Electricity Demand module)
- DER costs and utility cost recovery (feeds Cost of Service Module)
- Alternative business models (feeds Ratemaking Module)

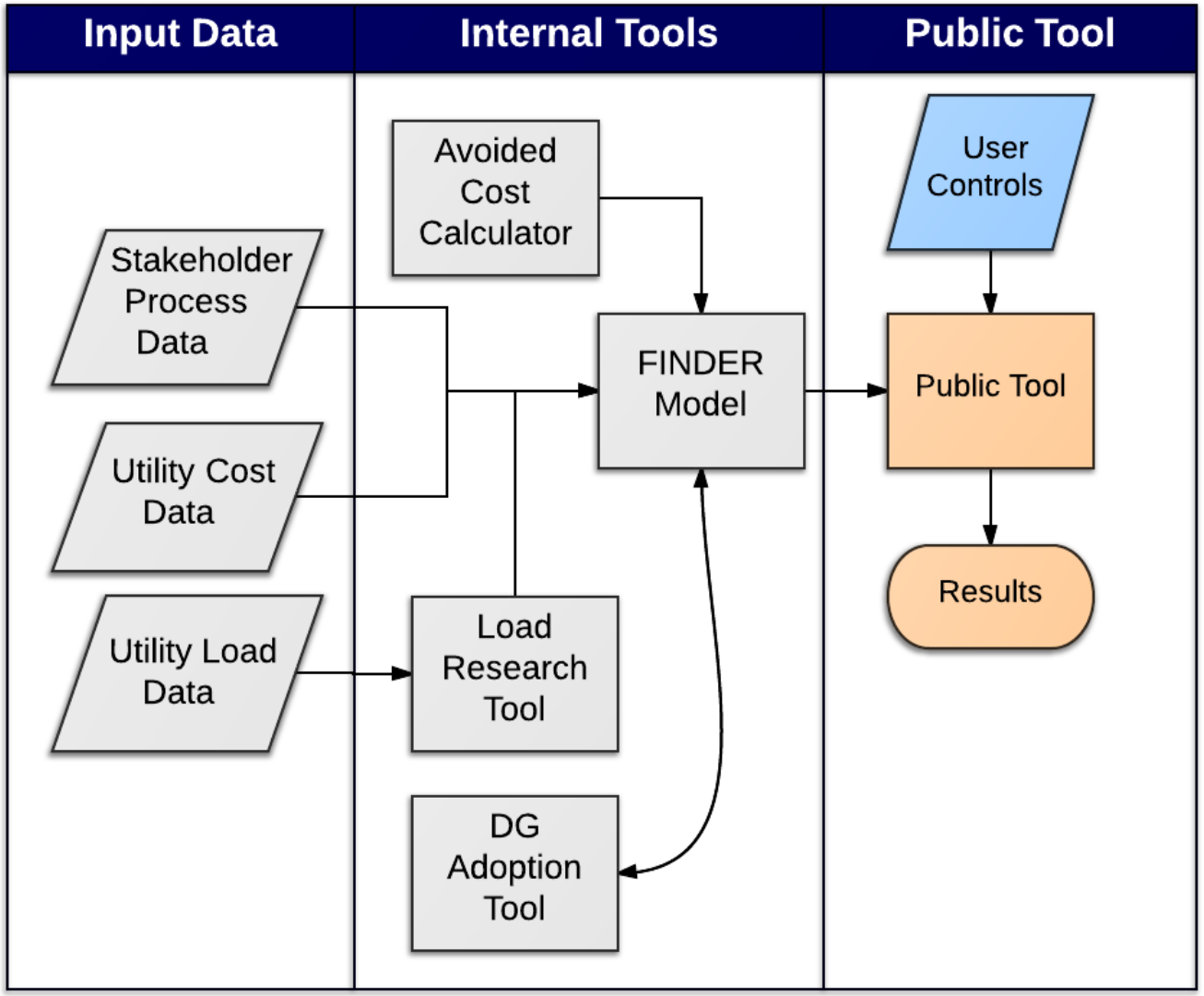
Resource Planning Module

- Sales and peak demand forecast
- Timing, generation type, and capacity of utility-owned generation investment

Ratemaking Module

- Frequency of rate cases
- Test year
- Regulatory lag
- Allocation of costs to rate components
- Billing determinants
- Retail rates
- Cost trackers, adjustments, and balancing accounts
- Off-system sales revenue

Public Tool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Adoption Projections and Renewable DG Growth Metrics

- **The impact of various rate structures on renewable DG is an important aspect of the Public Tool, given the objective of growing a sustainable distributed generation industry set forth in AB 327**
  - Particular focus on solar PV as it currently makes up a large proportion of existing NEM systems
    - The tool should forecast solar PV adoption over time under different rate structures since they will result in longer or shorter payback periods and likely less (or more) solar PV being adopted
    - Metrics used to determine solar PV growth
      - Policy-driven
      - Economic (IRR of participant)
  - The tool will also be able to model solar PV and other renewable DG technologies by direct user inputs

What is "Sustainable Growth" for Renewable DG?

- **Maintaining growth in total solar PV generation?**

(EIA 2014)	2010	2011	2012	2013
GWh solar	769	874	1,382	3,865

- **Maintaining growth in market share?**

(EIA 2014)	2010	2011	2012	2013
Solar as % of total CA electricity	0.38%	0.44%	0.69%	1.93%

- **Minimizing cost impacts to non-participating customers?**
- **Maintaining current installer/industry profit levels?**
- **Maintaining or bringing down the payback period for customers?**

Evaluation Metrics

+ Primary evaluation measures

- Ratepayer Impact Measure
- Renewable DG adoption
- Renewable DG profitability
- Results reported by Customer Class or Rate Schedule

+ Additional cost test calculation

- Total costs and total benefits
- Not a 'distributional test' that compares renewable DG owners and non-participants, but an assessment of whether renewable DG is cost-effective overall
- "Added Value" a user input; subjective, not defined by the project team

Stakeholder Discussion

- Do stakeholders have alternative suggestions about data inputs they would like to offer?
- Are there lessons learned from prior quantitative analyses and public tools that could be applied in this analysis?
- What key utility cost or load sensitivities should be available in the Public Tool?

Lunch
12:30 – 1:30 p.m.

Discussion of the Public Tool
1:30 – 2:30 p.m.

Public Tool: Agenda

- Proposed model functionality
- Term of analysis period
- Technologies
  - Scope of technology characteristics
  - Size
  - Cost
- Avoided costs
- Metrics

Public Tool Functionality

- **This tool will use outputs from the FINDER Model, the load research tool, and other tools as inputs**
- **The primary inputs are the revenue requirement by customer class over the forecast period and the associated billing determinants**
- **User will then be able to:**

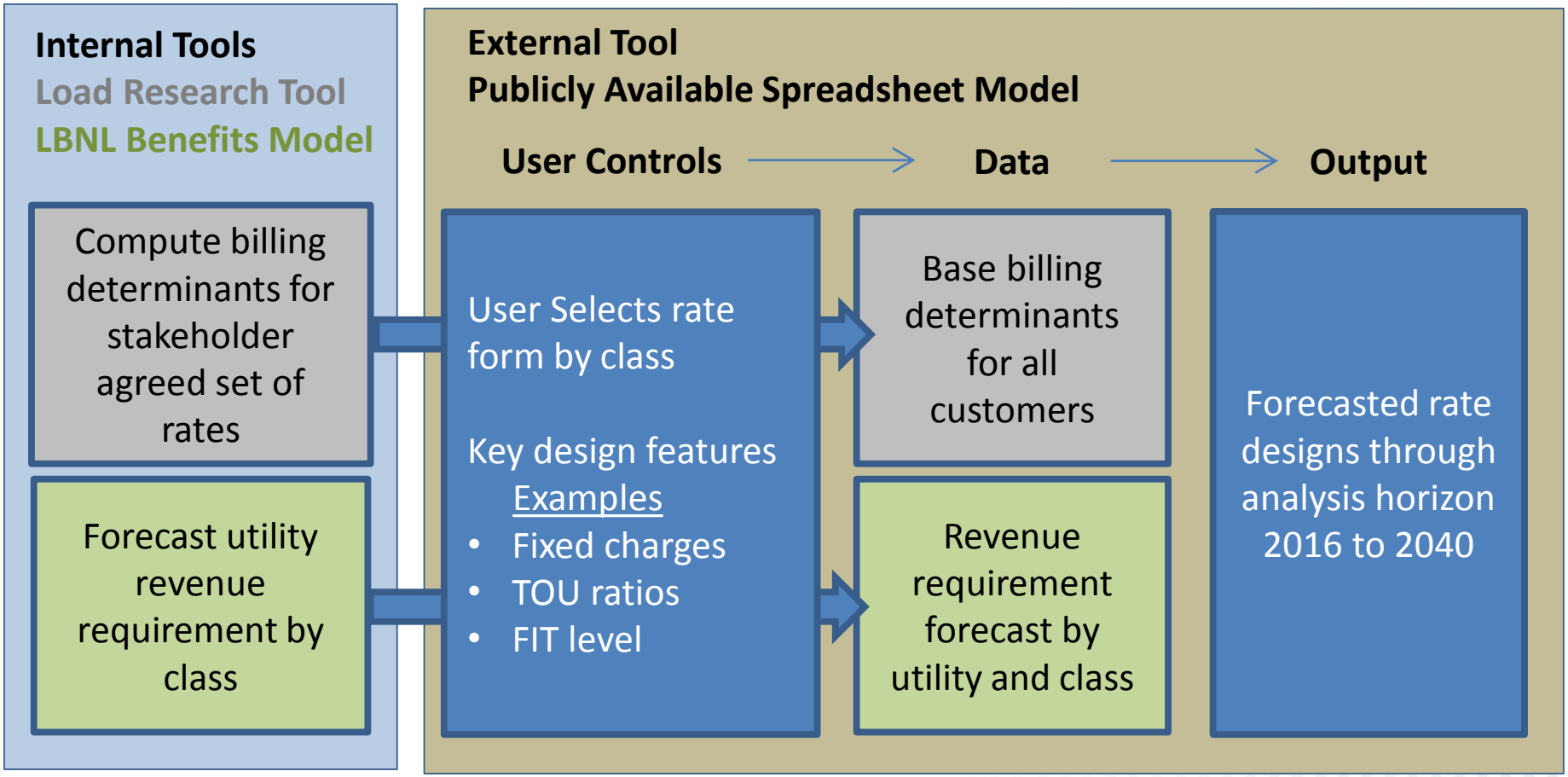
1. Change key inputs and estimate rate structures and rate levels for alternative rate designs
2. Input cost assumptions for renewable DG to estimate IRR, payback, and adoption
3. Input key drivers of avoided costs to estimate the cost shift to non-participating customers and utility cost savings

Public Tool
Step 1: Determine Rates

- **Define the rate structures for each customer class**
- **Define renewable DG and EE penetration (regulatory/economic scenarios)**
- **Example: TOU rate structure**
  - Select the peak to off-peak pricing ratio
  - Introduce a fixed customer charge
  - Select the fixed charge amount
- **Users will be able to define all but one of the rate components**
- **The tool will then forecast the remaining rate component such that the rate collects the class revenue requirement**

Public Tool
Step 1: Determine Rates

Step 1 **Forecast rates and rate components under user-specified structure**

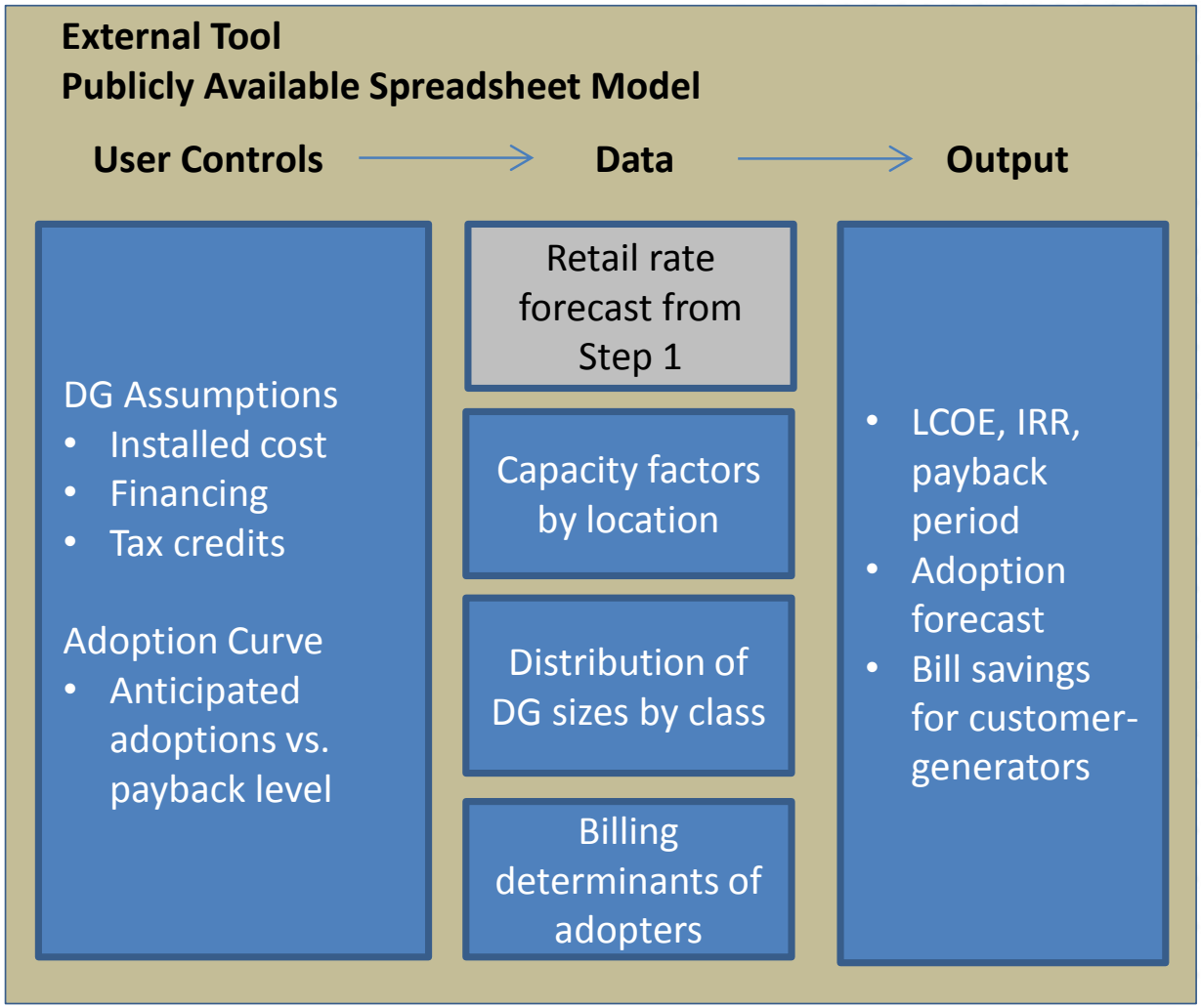


Public Tool
Step 2: Renewable DG Costs

- **Determine technology**
- **Determine cost**
  - Installed cost
  - Fixed costs
  - Financing, taxes and incentives.
- **Tool will compute**
  - System payback period and IRR
  - Economic adoption rate of new renewable DG systems
    - Input assumption of adoptions vs. payback period
- **Levelized cost of energy (LCOE)**
  - Can be equivalent to a third party PPA price under certain finance and tax assumptions.

Public Tool
Step 2: Renewable DG Costs

Step 2 **Forecast customer-generator payback, IRR and adoption rate**



Public Tool
Step 3: Utility Savings and Costs

- These assumptions collectively sum to the benefits of renewable DG
- Default values for each of the key avoided cost drivers equal the base case estimates used by E3 and the CPUC in the 2013 NEM Ratepayer Impact Study

Avoided Cost Category	Description
Generation Energy	Wholesale value of energy
System Capacity	Payments to cover new generation capacity
Ancillary Services	Providing system ops & reserves for reliability
T&D Capacity	Expanding trans. & dist.
CO_2 Emissions Cost	Emissions associated with marginal generating resource
Avoided RPS	Procuring lesser amount of renewables & meeting RPS
Added Value (user input)	Subjective 'lever' that can add an additional value in the total costs / benefits test

Public Tool
Step 3: Utility Savings and Costs

- Users will be able to vary these avoided cost categories across a range of sensitivities
  - Similar to the public tool in the 2013 NEM study
- With the bill savings estimated from Step 2 and utility savings from Step 3, the tool will then calculate the necessary increase in utility rates for non-participants attributable to the NEM successor contract/tariff program (if any) for each of the customer classes

Public Tool
Step 3: Utility Savings and Costs

Step 3 **Forecast utility cost savings and any cost-shift to non-participants**

Internal Tool
LBNL Benefits Model

Revenue requirement change by customer class

Utility financial impact of DG scenario; Earnings, EPS, ROE, volatility

External Tool
Publicly Available Spreadsheet Model

User Controls	Data	Output
Key drivers Avoided costs • Generation capacity value • LCR Zone value • T&D benefits • Others Costs • Interconnection • Integration cost • Billing and other	Bill savings of customer DG from Step 2 Adoption forecast from Step 2 Aggregate customer-generator system output	Non-participant Impacts • Utility RR savings from DG • Net cost-shift (if any) of rate design by customer class

Term of Analysis

- **Term must be long enough to support analysis of economic viability of proposed alternative tariffs**
- **Recommendation – Evaluate the long-term**
  - Track new installations of renewable DG systems to 2025
  - Evaluate lifecycle economics until 2050
- **Rationale**
  - Looking at systems installed to 2020 will not result in much incremental penetration, dominated by transitioned systems
  - Ideally, we identify long-term solution or 'glide path'
- **Requires long-term forecast, well beyond utility GRC information. Recommend extending the LTPP reference case assumptions for long-term forecast.**

Proposed Scope of Technologies

- **Technologies suitable for customer generation**
  - Solar PV
  - Wind
  - Biomass and biogas
    - This was not included in the 2013 NEM study
- **Consideration of battery storage**
  - We recommend including a combined PV & storage 'technology' to the technology list in consideration
  - Incentive structures will change the way storage operates
- **Exclude Fuel Cell NEM (FC NEM) for natural gas fueled fuel cells which is an entirely different tariff**

Storage

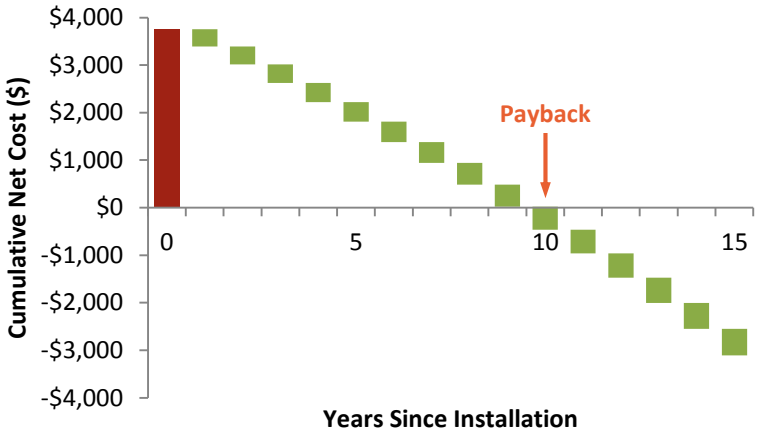
- **Assumptions about how to characterize storage and its compensation structure, assumptions about system lifetime and other aspects are uncertain**
  - Coupled
  - Stand-alone
- **Propose:**
  - Can input range of future costs
  - Adjust output shape for storage based on use case
    - Use case 1; use storage to maximize bill savings
    - Use case 2; use storage to maximize utility avoided costs

System Size

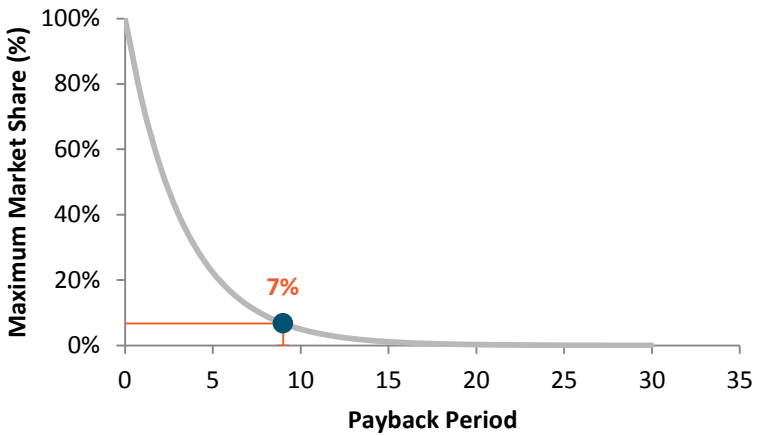
- **There have been various rules on allowable size of NEM systems over time**
- **We propose to evaluate renewable DG systems up to those sized such that annual production = annual consumption (e.g. sized to annual loads)**
- **Rule 21 Limit of 1.5 MW RDG Size**
  - In their informal comments, SCE recommends up to 1.5 MW to coincide with the fast track process under Rule 21.
  - For the vast majority of customers this is not significantly different. We are not defining the policy here, but estimating the cost shift. That said, we could implement this alternative size limit.

Internal Model Assessment of Renewable DG Adoption

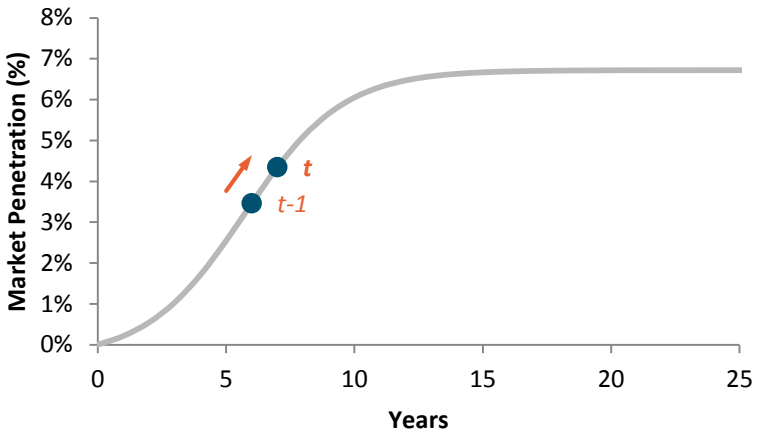
1. Determine payback period



2. Determine max market share



3. Fit logistic curve

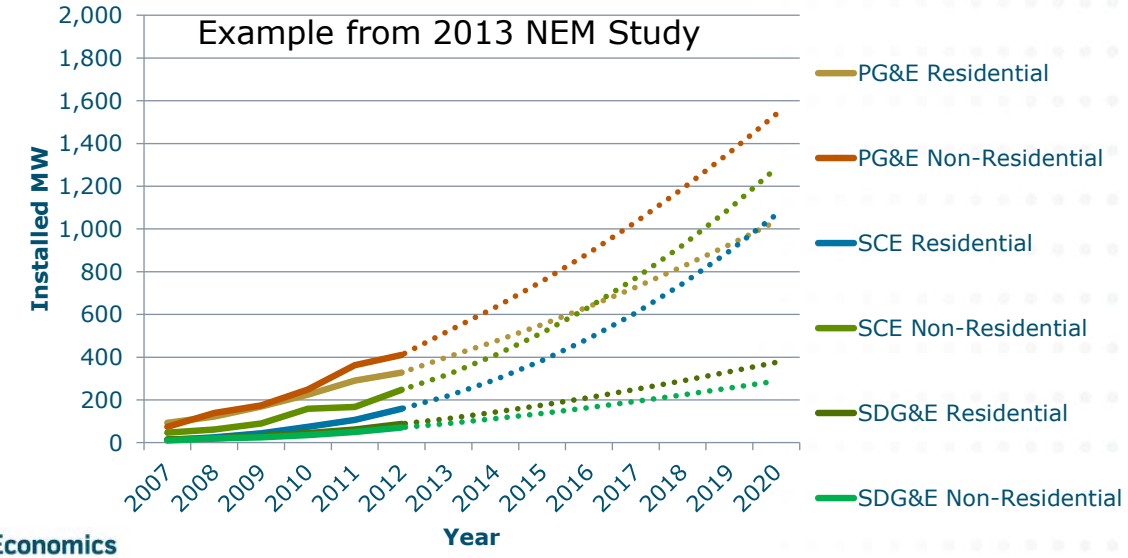


4. Apply to technical potential

	Technical potential	MW
x	Market penetration at *t*	%
=	**Installed capacity at *t***	**MW**

Renewable DG Adoption Options

- **Can use direct user inputs, existing tools like E3's WECC solar PV market adoption model, or a combination thereof**
- **To determine renewable DG market size we suggest the following:**
  - For solar PV, market size based on adoption rates from customer financial proposition (see E3 WECC market adoption tool):
    - https://www.wecc.biz/Lists/Calendar/Attachments/5811/131220_E3_TEPPC_MktDrivenDG_2024CC.pdf
  - Fixed direct user inputs to determine market size of various renewable DG technologies, e.g. reach NEM cap by certain year or historical trend



Renewable DG Costs

- **Key input in Public Tool**
- **Will affect adoption and renewable DG cost-effectiveness tests of various successor contract/tariff designs**
- **Can be varied over time in the user inputs**
- **Other assumptions**
  - Analysis period
  - Discount rate
  - Ownership model
- **All federal and state tax credits and incentives are modeled to expire as expected**
  - For example, ITC will decrease from 30% to 10% in 2017

Feedback Issues and Approximation

- **The avoided cost inputs in the Public Tool are approximations since there are several feedback effects in the analysis**
  - For example, the marginal energy and capacity costs would change with increasing levels of renewable DG penetration
- **Our proposed solution is to use the internal tool to estimate several levels of renewable DG adoption and then use interpolation in the Public Tool**
  - However, change in utility revenue requirement in the Public Tool may not be exactly consistent with results of a more detailed analysis: the Public Tool may also need to have some reasonable limit on renewable DG penetration

Sensitivities

- **One of the primary purposes of the Public Tool is to allow the user to do sensitivity and 'what-if' analyses**
- **Proposed Functionality for Sensitivity:**
  - Utility costs and avoided costs
    - Natural gas prices, utility-scale renewable costs, CCGT capital costs, transmission capital costs, distribution capital costs
  - Utility costs to support customer generator costs
    - Interconnection costs, initial set-up cost, billing cost
    - Integration costs
  - Participant costs
    - 3rd party economic drivers (ROE, tax treatment, life, O&M)

Stakeholder Discussion

- For the term of the analysis period, are there any reasons to select a shorter analysis period and/or a longer analysis period? If so, what are those reasons and why should those alternative analysis periods be used?
- What technology types are not included in the proposal that stakeholders would like to include, and why? Similarly, what technology types are included in the proposal that stakeholders would like to exclude, and why?
- What technology characteristics, for the proposed technology types, would stakeholders like to add or remove from the proposed list, and why?

Break
2:30 – 2:45 p.m.

Discussion of Pricing Mechanisms for the Public Tool
2:45 – 4:00 p.m.

Pricing Mechanisms for the Public Tool: Agenda

- Ratemaking 101
- NEM Compensation Overview
- NEM options
  - Residential tariff options
  - Non-residential tariff options
- Renewable feed-in tariff options

Basic Steps in Setting Rates – Step 1 of 3

- **Establish the total revenues that the IOU should collect**

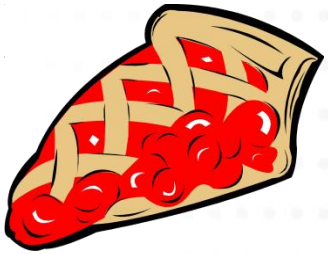
"How big is the pie?"

- **This is based on the IOU's cost of service ("embedded" costs) and is called the revenue requirement**
- **As this amount changes, it drives the overall rate level change for the utility**

Basic Steps in Setting Rates – Step 2 of 3

- **Determine how much revenue should be collected from each customer class**

"How big is our slice?"



- **This step is called <u>cost allocation</u> and allocates costs to customer classes**
  - Allocation can be determined in a variety of ways
  - The customer classes correspond to the IOU's rate schedules

Basic Steps in Setting Rates – Step 3 of 3

- Design rates to collect those cost allocations

"What is the recipe?"

- Rate design is the method by which the allocated costs are collected from each customer class
- Many different rate designs can collect the same class revenue allocation

Two Categories of Compensation

NEM (Compensation at Retail Rates)	Feed-In-Tariff (Compensation Independent of Rates)
+ **Compensation levels driven by rate design** • Pure embedded cost-based rates • Other rate designs + **Embedded cost allocation and rate design differ by class** • One customer class • NEM participants and non-participants in separate classes	+ **Level and design could be based on:** • Value of Solar • Value of Renewables • Renewable DG capital or financing costs

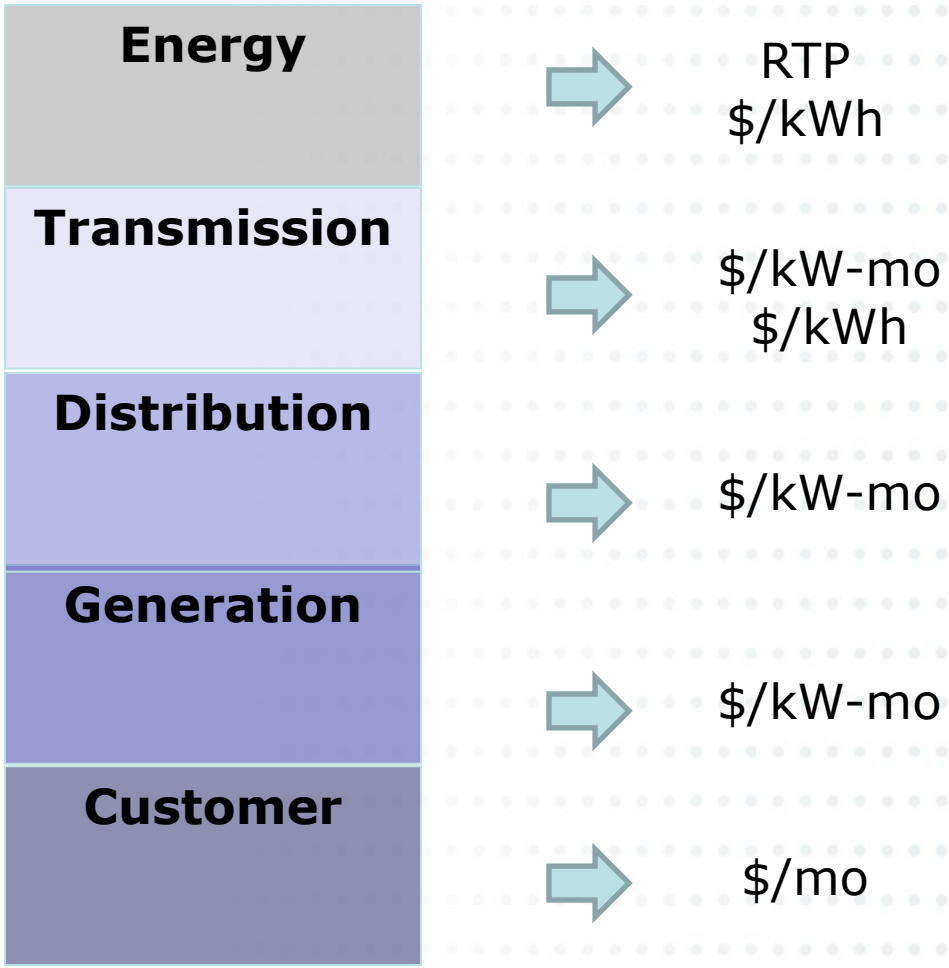
Current NEM program generally compensates generation (excluding surplus) with embedded cost rates designed for all ratepayers in class.

Implications for NEM Options in the Public Tool

- **The Public Tool will use as inputs the revenue requirement by customer class, and allow adjustment to the rate designs**
  - Feed-in tariff options will also be evaluated
- **All of the embedded cost rate designs collect the same customer class revenue allocations**
  - Users of the Public Tool will not be able to change class revenue allocations
- **The Public Tool will assess NEM customer and non-participating ratepayer impacts of embedded cost rate designs with NEM**

A Cost-Based Embedded Cost Rate Design Results in No Cost Shifting

- A cost-based rate design based on embedded cost is economically efficient and results in no cost shifting among participating and non-participating customers
- All customers in a class pay customer-specific cost of service



Other Considerations in Rate Design

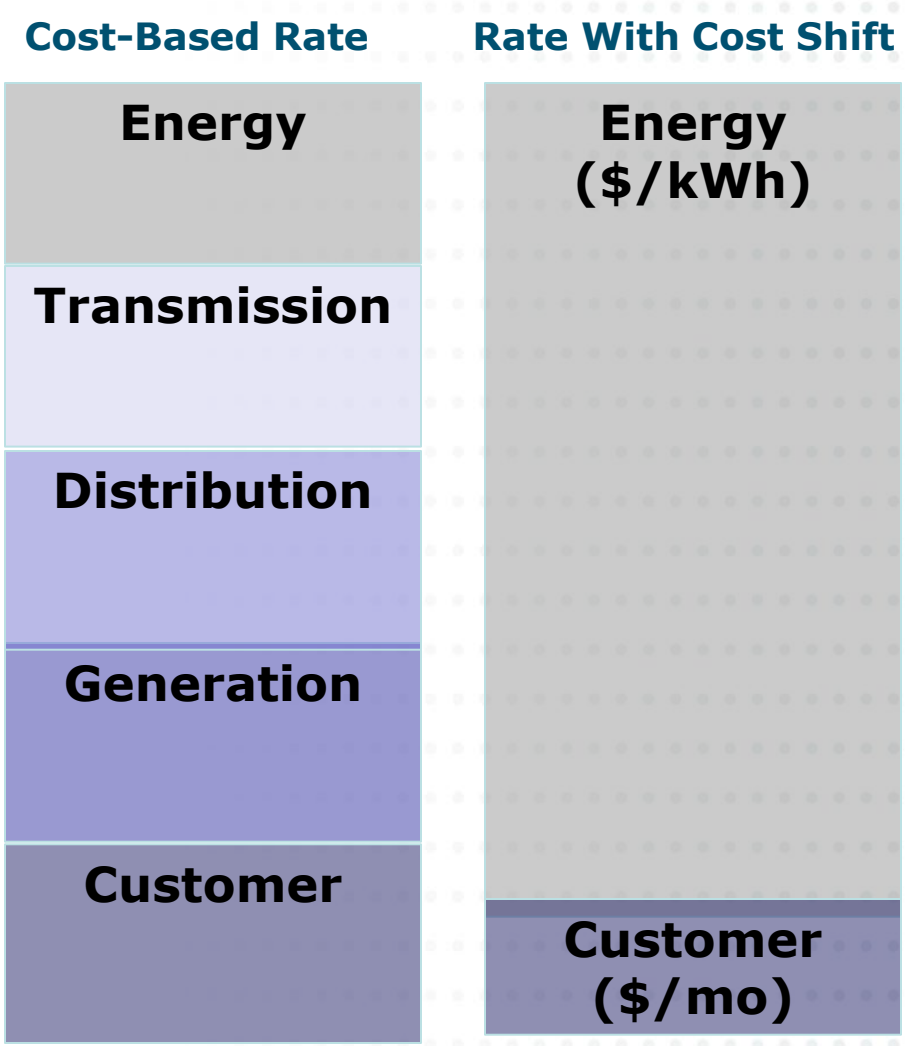
- **Other motives can cause rate design to deviate from a pure embedded cost basis, for example:**
  - The desire to provide a conservation price signal
  - Promotion of electric vehicles
  - Low income customer programs
- **Cost shifting occurs when rate design deviates from embedded cost**
- **Questions that typically arise when designing rates:**
  - How closely should rates conform to embedded costs?
  - How should costs be allocated to specific customers classes in the context of public policy or other goals?
  - To what degree may rate structures deviate from current designs?
  - Does the utility desire to maintain a stable, long-run price signal? If so, how should that price signal be established?
  - What are the bill impacts on existing customers from a rate change?

Impacts of Rate Design Choice on Customers

- **Changes in rate design will affect each customer differently**
  - Because customers are diverse in usage patterns, each customer in a class may pay a different average rate ($ bill / kWh usage)
  - This can be further exacerbated by NEM generation and compensation
- **This can occur even though potential rate designs for a given class are generally meant to collect the same revenue for the entire class in aggregate**
- **Thus changes in rate design ultimately impact cost allocation to each customer, even if the class revenue allocation is unchanged**

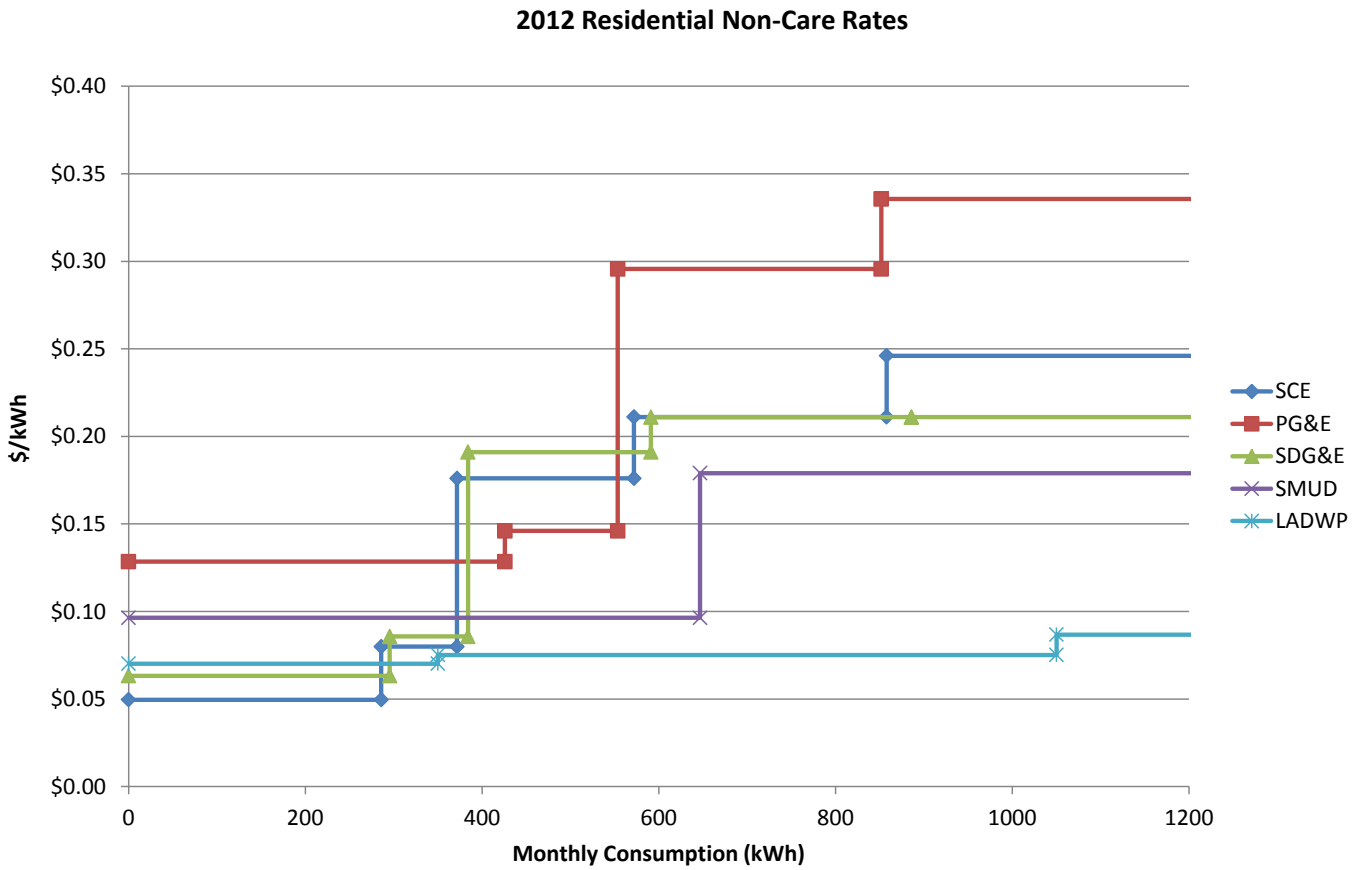
Cost Impacts Occur When Rate Design Deviates From Cost Basis

- **Cost impacts within a customer class occur when the rate design differs from the cost basis**
- **Such rate designs include:**
  - TOU
  - Seasonal
  - Tiers
  - Fixed Charge
  - Minimum Charge
  - Combinations (i.e., seasonal tiered TOU with minimum charge)



California Residential Retail Rates

- **Current residential "tiered" rates have higher charges for higher usage and low-income and economically vulnerable customers are protected from higher rates with legally defined discounted "CARE" rates**



Residential Rate OIR Relationship to NEM Successor Contract/Tariff

- **The current NEM successor contract/tariff proceeding focuses on:**
  - More specific information on customer-side generation, i.e. cost impacts and utilizing a much longer analysis period
- **The residential rate OIR is a separate proceeding that is considering a variety of options**
  - Simplifying the tiers of the inclining block rate structure
  - Default TOU pricing
  - Fixed or minimum monthly charges up to $10 for non-CARE customers and $5 for CARE customers indexed to CPI growth
  - Residential demand charges
  - Critical peak pricing
  - Peak-time rebates for rewarding voluntary demand response

Residential Rate Design Options

- **We propose to offer the following rate structure options in the Public Tool**
  - Existing rate design (e.g. inclining block rate)
  - Rates proposed in Residential Rates OIR
    - 2-tier (baseline = 50% - 60% of average usage)
    - TOU (summer 3 periods, winter 2 periods)
    - Tiered TOU
  - Embedded cost-based rate components
  - In combination with above rate components: fixed charge, minimum bill
    - Users can model any fixed charge or minimum bill as long as the rate collects the class revenue requirement
- **These changes would apply to transitioning NEM systems as well as new systems**
- **We would like your feedback on what other rate structures we should consider making available in the Public Tool**
  - Other baselines, other TOU periods, different season definitions, etc.

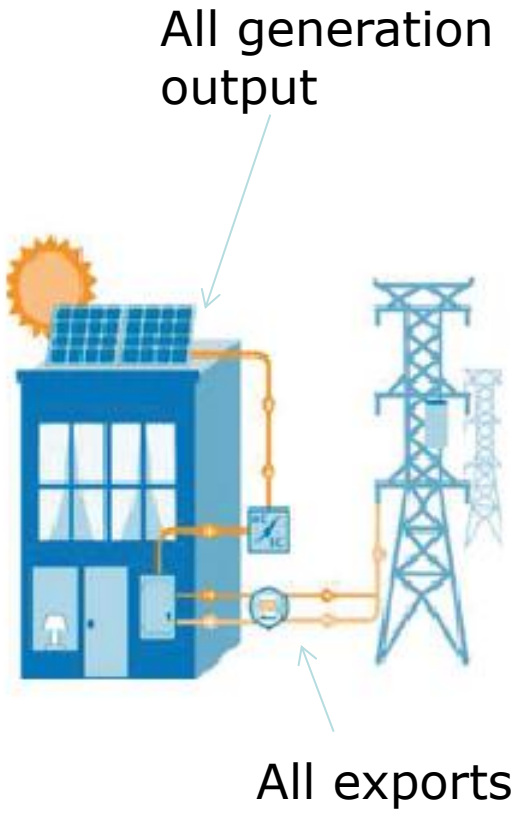
Other Design Options for Customer-Side Generation Only

- **Additional charges that only apply to customer-side generators:**
  - Residential and non-residential
    - Grid/network use charge on exports ($/kW-month)
    - Network use charge on exports ($/kWh)
    - Non-bypassable public purpose charge
  - Non-residential
    - Standby charge ($/kW-mo)
    - Tiered demand charge ($/kW-mo)
- **These charges would not apply to transitioning NEM systems**

Non-Residential Rate Design Options

- **We propose to offer the following rate structure options in the Public Tool:**
  - Existing rate designs (i.e., fixed charge, TOU and flat energy charges, monthly and seasonal TOU demand)
    - Changing the relationship between energy and demand charge levels would change the result on bill savings and cost-shifting
  - Embedded cost-based rate components
- **We would like your feedback on what other rate structures we should consider making available in the Public Tool**
  - Other TOU periods, different season definitions, etc.

Public Tool Will Model Asymmetric Compensation



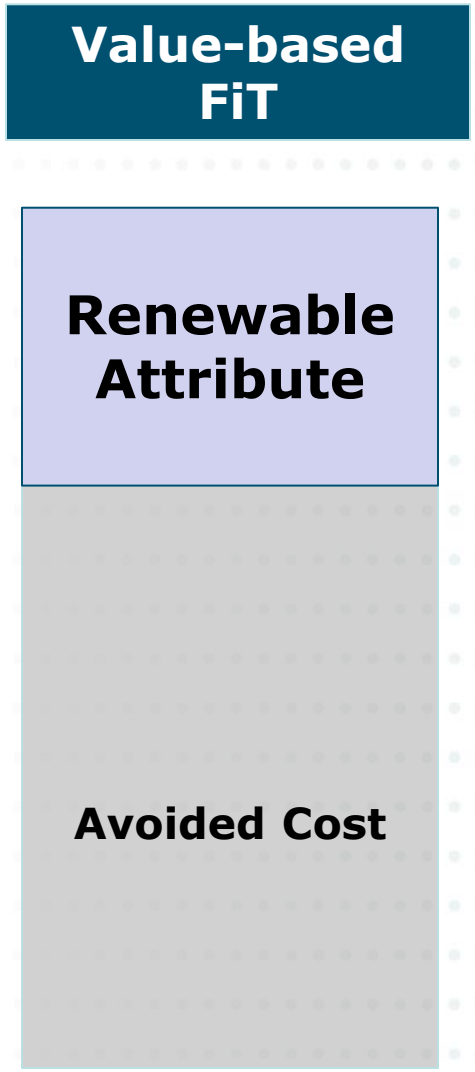
- **On an annual basis, behind-the-meter output is the sum of:**
  1. Generation consumed
  2. Generation exported that is later consumed
  3. Surplus generation exported
- **Each of these quantities may be compensated at a different rate**
  - Current NEM compensates all generation and exports at the same rate, surplus at a (significantly) reduced rate
- **Storage**
  - Can limit or time-shift exports
  - Asymmetric compensation can incentivize storage systems behind the meter
- **We would like feedback on stakeholder interest in asymmetrical compensation**

Renewable Feed-in-Tariff ("FiT")

- **Feed-in tariffs enable departure from embedded cost rates**
- **Feed-in tariffs can decouple compensation for generation and usage**
  - Hybrid NEM/FiT models that compensate behind-the-meter and exported generation differently do not achieve this
- **Potential FiT values:**
  - Could establish compensation based on avoided costs plus a purchase of renewable energy value
  - Could establish compensation based on estimated system costs with a schedule or procession of reductions based on prices or volumes

Value-based FiT Can be Structured in Many Different Ways

- Payment ($/kWh) as the sum of avoided cost and renewable attribute
  - Could decline with time
  - Could include TOU variation
  - Could vary by technology
- Renewable attribute could be set in a number of ways
  - Competitive procurement, REC market price, regulatory mechanism with an adjustment over time or volume
- Could apply to gross generator output (Austin Energy, Minnesota) or only exports to the grid



Cost-based FiT can be Structured in Many Different Ways

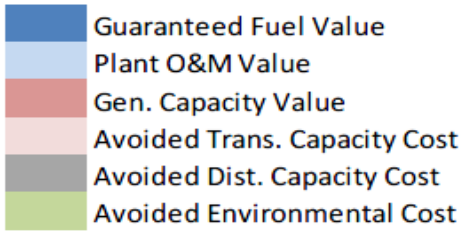
- Payment ($/kWh) set based on estimated cost to achieve a target adoption level
  - Could vary by time-period and season
    - Rewards better tilt, west-facing, etc.
  - Could vary by utility and geography
    - Eg. Long beach vs. Palm Springs
- Difficult to set at the appropriate level, given cost uncertainty and regulatory lag in the process
  - A regulatory mechanism could adjust price for future vintages based on volume and/or prices
- Cost-benefit analysis would require estimating portion of avoided cost
- Probably only makes sense as compensation for gross output

Export-Only Compensation

- Establishing an avoided cost payment for only energy exports to the grid could result in smaller system sizes, as customer generators seek to consume as much generation as possible onsite
- If we assume avoided cost payments for exports only (customers offset onsite load similar to EE), customers would likely size to peak demand rather than annual load

FiT Example – Austin Energy

- **Austin Energy in 2012 adopted Value of Solar (VOS) tariff for residential customers where each component of the "value" is forecasted for 25-years, then levelized, and applied to total solar production**
  - The VOS rate is recalculated annually and all customers including existing customers receive the new VOS rate
    - Current 2014 VOS rate is 10.7¢/kWh
  - Any unused VOS credit expires after 12-months



	Economic Value ($/kWh)	Load Match (No Losses) (%)	Distributed Loss Savings (%)	Distributed PV Value ($/kWh)
Guaranteed Fuel Value	$0.053		4%	$0.055
Plant O&M Value	$0.005		4%	$0.005
Gen. Capacity Value	$0.026	62%	6%	$0.017
Avoided Trans. Capacity Cost	$0.015	62%	6%	$0.010
Avoided Dist. Capacity Cost	$0.000	39%	7%	$0.000
Avoided Environmental Cost	$0.020		0%	$0.020
	$0.119			$0.107

Source: http://www.cleanpower.com/wp-content/uploads/2014-VOS-at-Austin-Energy-Results-2013-10-21.pdf

FiT Example - Minnesota

- **Minnesota proposed VOS rate for gross solar production based on the value of solar DG to the utility, its customers, and society**
  - VOS rate = present value of 25-year contract rate
    - Can be fixed or escalating rate, but present value is the same
    - Any unused VOS credit expires after 12-months

25 Year Levelized Value

	Gross Starting Value ($/kWh)	× Load Match Factor (%)	× (1 + Loss Savings Factor (%)) = Distributed PV Value ($/kWh)
Avoided Fuel Cost	$0.061		8% $0.066
Avoided Plant O&M - Fixed	$0.003	40%	9% $0.001
Avoided Plant O&M - Variable	$0.001		8% $0.001
Avoided Gen Capacity Cost	$0.048	40%	9% $0.021
Avoided Reserve Capacity Cost	$0.007	40%	9% $0.003
Avoided Trans. Capacity Cost	$0.018	40%	9% $0.008
Avoided Dist. Capacity Cost	$0.008	30%	5% $0.003
Avoided Environmental Cost	$0.029		8% $0.031
Avoided Voltage Control Cost			
Solar Integration Cost			
			$0.135

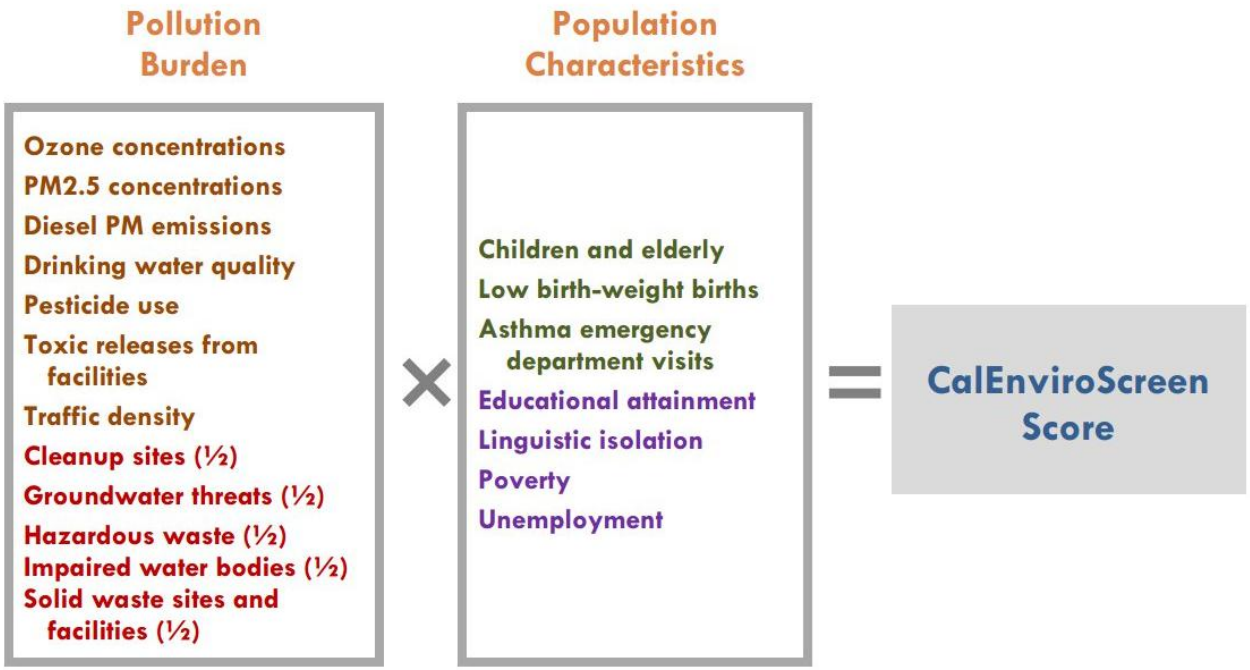
Source: https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7bEE336D18-74C3-4534-AC9F-0BA56F788EC4%7d&documentTitle=20141-96033-02

Disadvantaged Communities

- **How should disadvantaged communities be identified?**
  - Propose CARB definition (CalEnviroScreen Tool), or possibly the Population Characteristics component of the score
- **What are the goals of the program for disadvantaged communities?**
  - Environmental, economic development, bill payment, other?
- **Should there be specific rates or programs for disadvantaged communities?**
  - Higher compensation mechanisms or incentives? Higher value of renewable attribute? Other mechanisms?
  - The current CSI SASH and MASH programs could also be a model

Disadvantaged Communities – CalEnviroScreen

- For the purposes of AB 32 (Nunez, 2006), Disadvantaged Communities are defined using the CalEnviroScreen Tool (Version 1.0)

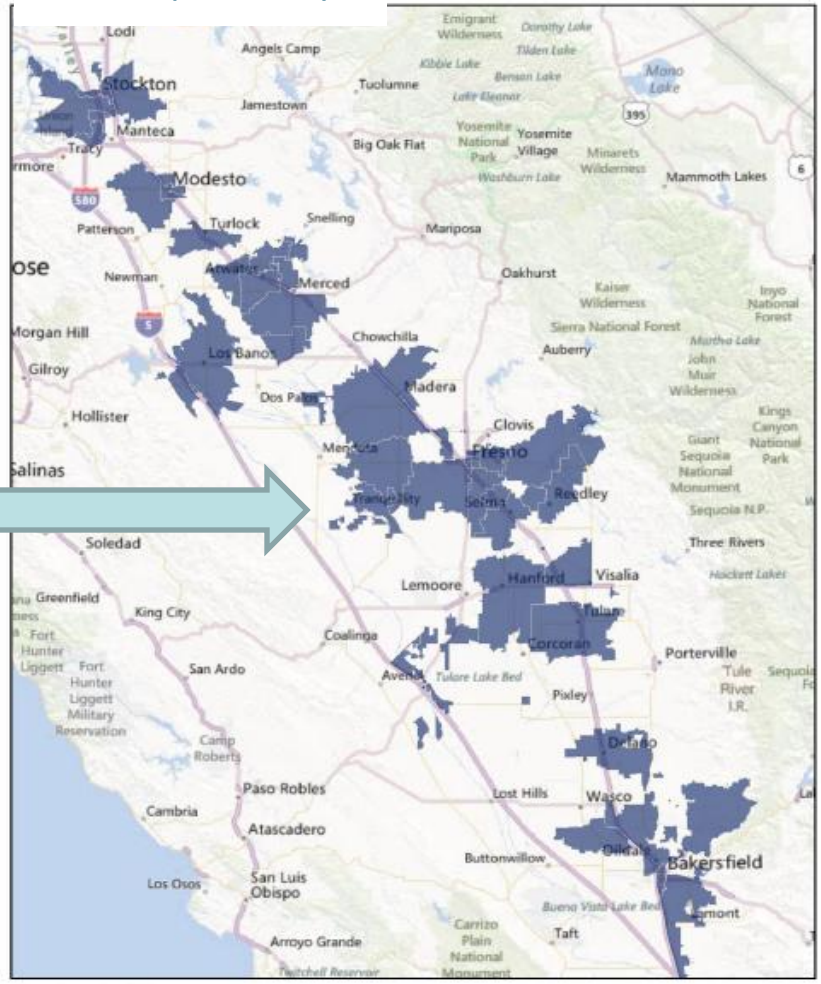


Max score: 10 X Max score: 10 = Max score: 100

Disadvantaged Communities – CalEnviroScreen

California:

San Joaquin Valley:



+ Definition will be updated with CalEnviroScreen 2.0 when finalized

Issues for Discussion

- **Who should bear the costs if the FiT value is above the value of distributed renewable generation?**
  - We recommend that we allocate any additional costs within the rate class rather than to all customers
- **Pricing the renewable attribute**
  - Cost-based such that avoided cost plus renewable attribute equal to renewable generator cost, regulatory mechanism to adjust over time
- **Multiple account net metering**
  - Propose to follow current rules for multi-family and contiguous accounts

Stakeholder Discussion

- What rate structures should be added and/or removed from the list of options, and why?
- What types of tariff or contract options should be included/excluded from the list, and why?
- Within the proposed rate options, are there any specific time-of-use periods, baselines, or other components that should be included?
- Are there any other rate options that could be considered to address the requirement in AB 327 to create alternatives designed for growth in disadvantaged communities?

Energy+Environmental Economics

Thank You!

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